Hydrometeorology Testbed (HMT) Overview

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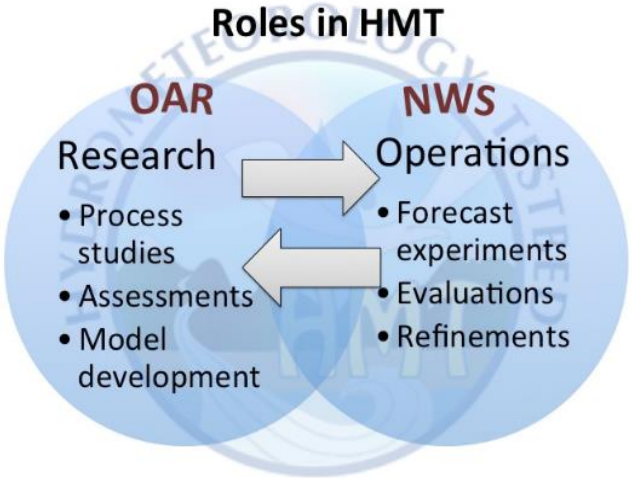
NOAA Testbed and Proving Ground Workshop, 6-7 April 2016

NEW HMT Charter

Improving forecasts of extreme precipitation and forcings for hydrologic prediction

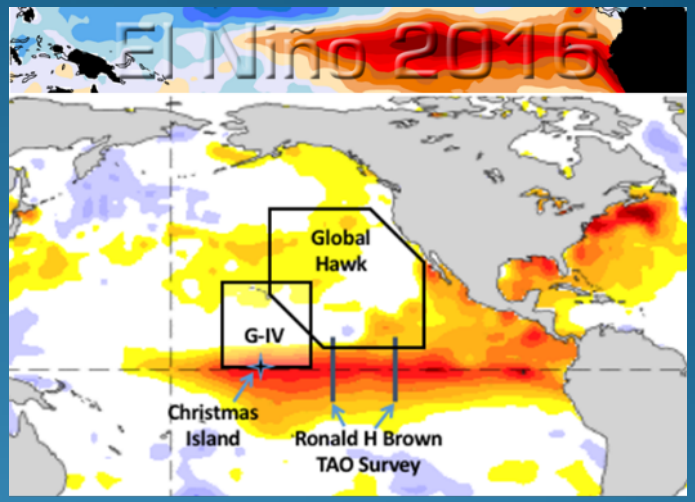
Co-managed by the OAR Physical Sciences Division (PSD) and the NWS Weather Prediction Center (WPC) in partnership with the National Water Center (NWC).

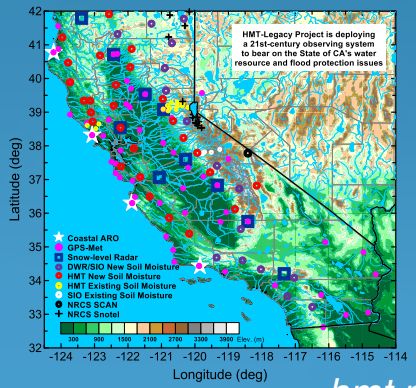
- Focused on TRLs 5-8
- Directed towards operational requirements of WPC and NWC
- Advance any regional demonstrations to national applications

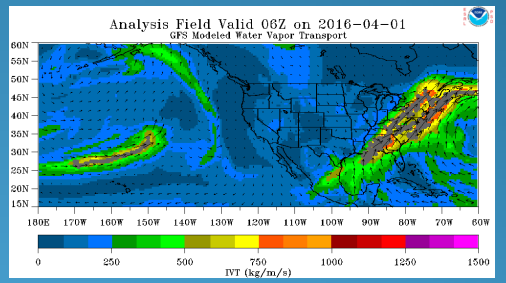


HMT Recent Accomplishments

- El Niño Rapid Response Project
  - NOAA G-IV based in HI (22 flights)
  - NASA Global Hawk based in CA (3 flights)
  - Soundings from Christmas Is. & Ron Brown
  - Gap-filling radar in Santa Clara, CA
  - Dedicated PSD/GSD Forecast Team
  - Data archive for future HMT projects to assess model QPF
- HMT-SEPS/Sandy Supplemental
  - ARDT developed
    - *To be evaluated in 2016 FFaIR*
  - Pub. on role of ARs in SE US
  - Snow-level radar at Plymouth, NH
  - AR Portal established
- Five OWAQ funded HMT projects
- WPC-led Winter Weather and Flash Flood Experiments





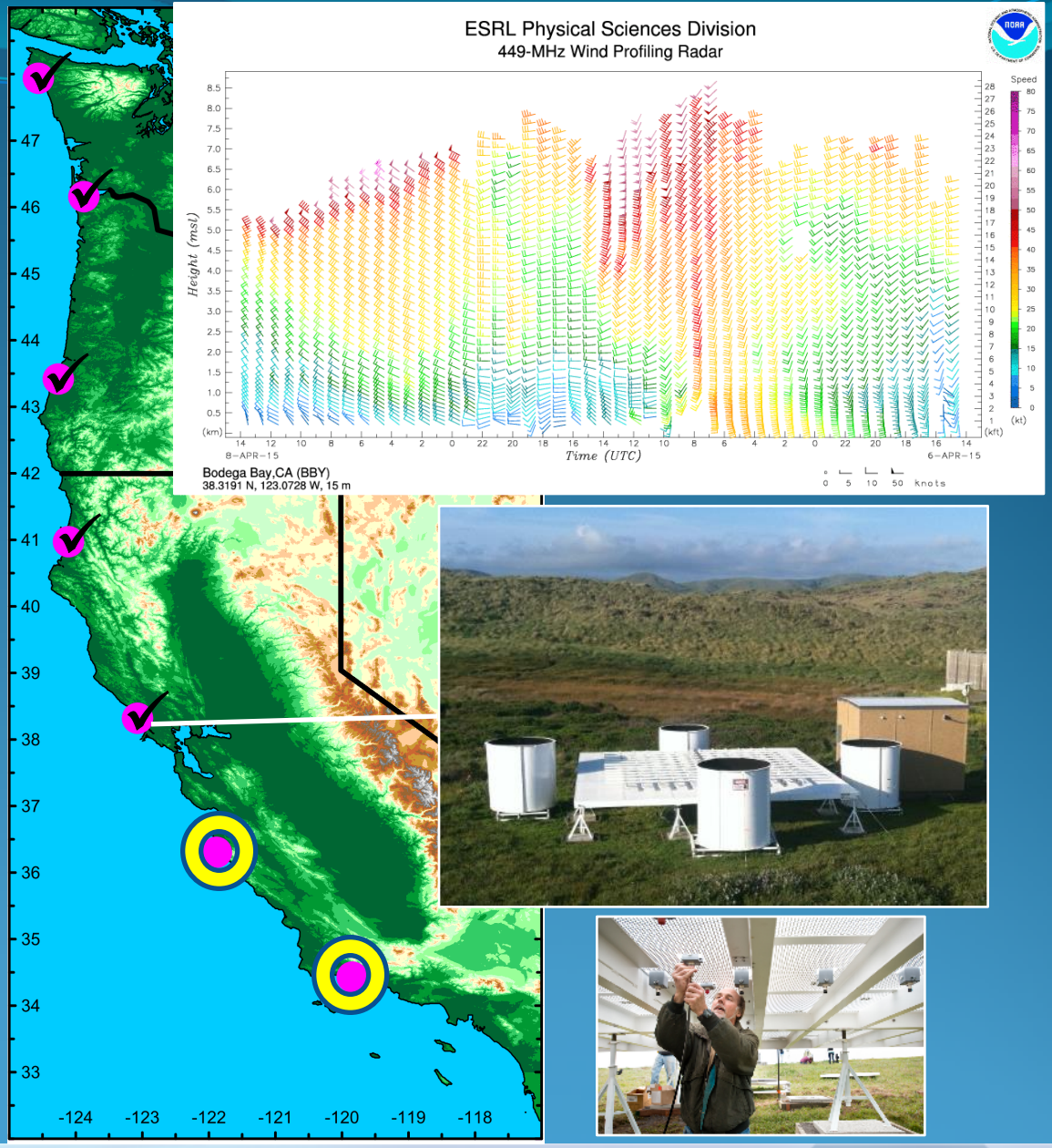


hmt.noaa.gov
wpc.ncep.noaa.gov/hmt/

Hydrometeorology Testbed

Coming in 2016

- PSD installing a “picket fence” of Atmospheric River Observatories (AROs) along the West Coast for weather and wind energy applications.
- Funding for the network provided by California Dept. of Water Resources and the U.S. Dept. of Energy.
- Observations can be leveraged by HMT researchers to evaluate model performance
- Most of network became available in or before 2015. Final two sites in CA will be installed in 2016.



HMT Projects

OWAQ Supported Projects

- Demonstration of Advanced Ensemble Prediction Services for NWS Hydrometeorological Forecast Operations *(Kelly Mahoney, NOAA PSD/ D. Gochis, NCAR)*
- Impact of cumulus scheme on the performance of microphysics scheme *(Dave Kingsmill NOAA PSD/CIRES)*
- Hydrometeorological Testbed Multi-Radar Multi-Sensor Hydro Experiment (HMT-Hydro) *(JJ Gourley, NOAA NSSL)*
- Assessment of Gridded Hydrological Modeling for NWS Flash Flood Operations *(Lynn Johnson, NOAA PSD/CIRA)*
- Storm Scale Ensemble Prediction Optimized for Heavy Precipitation Forecasting in Support of HMT *(Ming Xue, University of Oklahoma)*

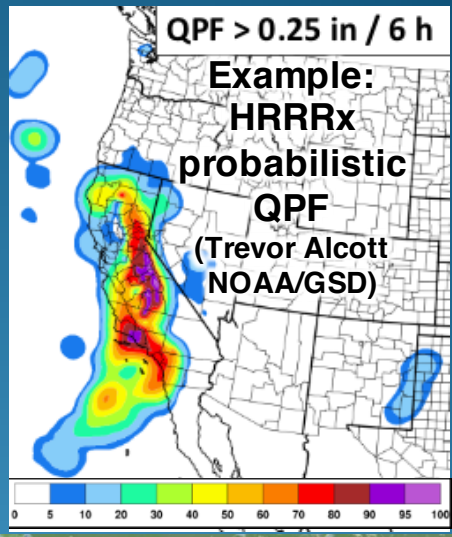
NIDIS Supported Project

- The Evaporative Demand Drought Index (EDDI) (*Mike Hobbins, PSD/CIRES)*

Project #1 (HMT/OWAQ): Demonstration of Advanced Ensemble Prediction Services for NWS Hydrometeorological Forecast Operations

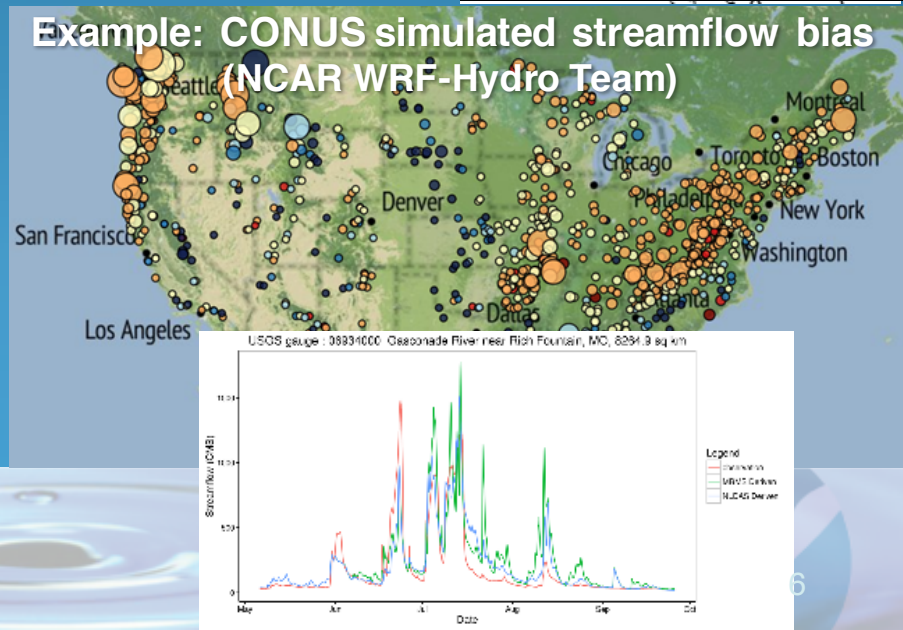
Objectives:

- Generate probabilistic QPFs from HRRR-based (high-resolution, convection-allowing) forecasts
- Incorporate into physics-based, distributed hydrologic modeling framework (WRF-Hydro)
- Produce improved combined hydrometeorological forecasts
- Develop in close collaboration with operational forecasters



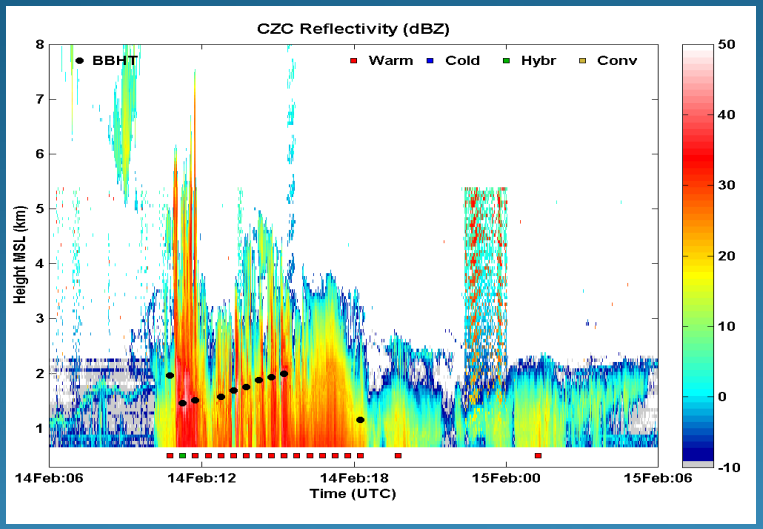
Multi-agency team:

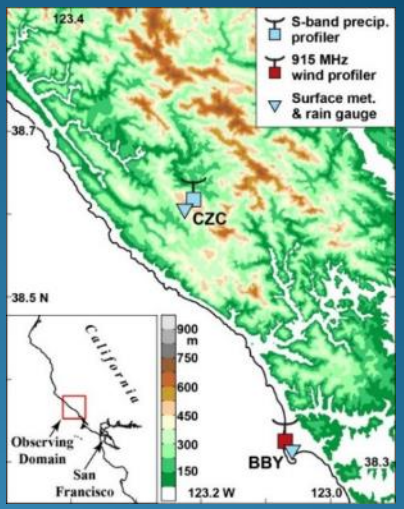
- Kelly Mahoney (NOAA/PSD)
- Dave Gochis (NCAR)
- Trevor Alcott (NOAA/GSD)
- Rob Cifelli (NOAA/PSD)
- Stan Benjamin (NOAA/GSD)
- Brian Cosgrove (NOAA/NWC)
- Chad Kahler (NOAA/NWS/WRH)
- Mark Strudley (NOAA/NWS/WFO Monterey)
- Daniel Nietfeld (NOAA/NWS/WFO Omaha)

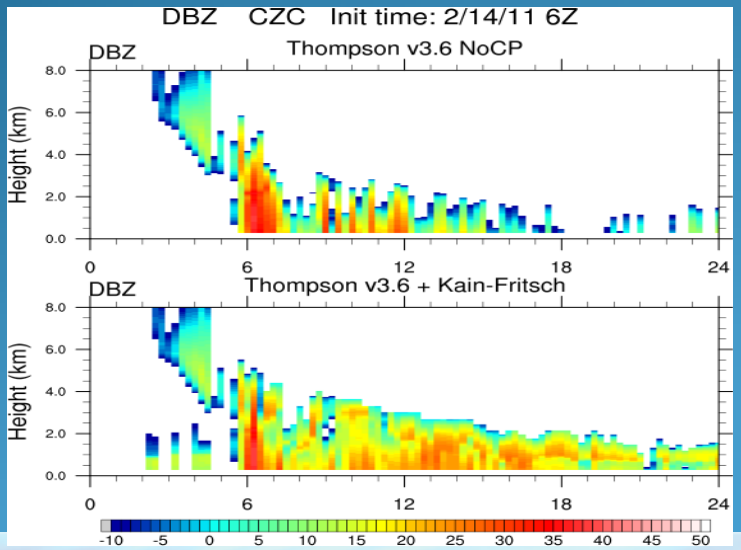


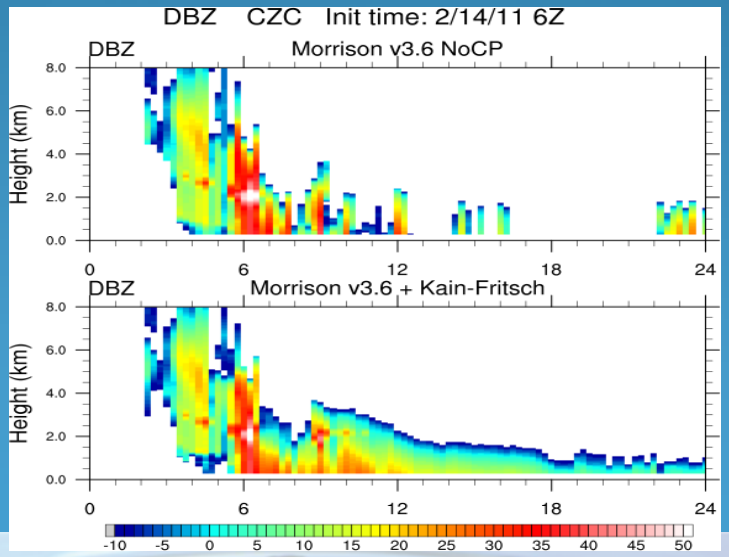
Project #2 (HMT/OWAQ): Impact of cumulus scheme on the performance of microphysics scheme

HMT-West Coastal Domain



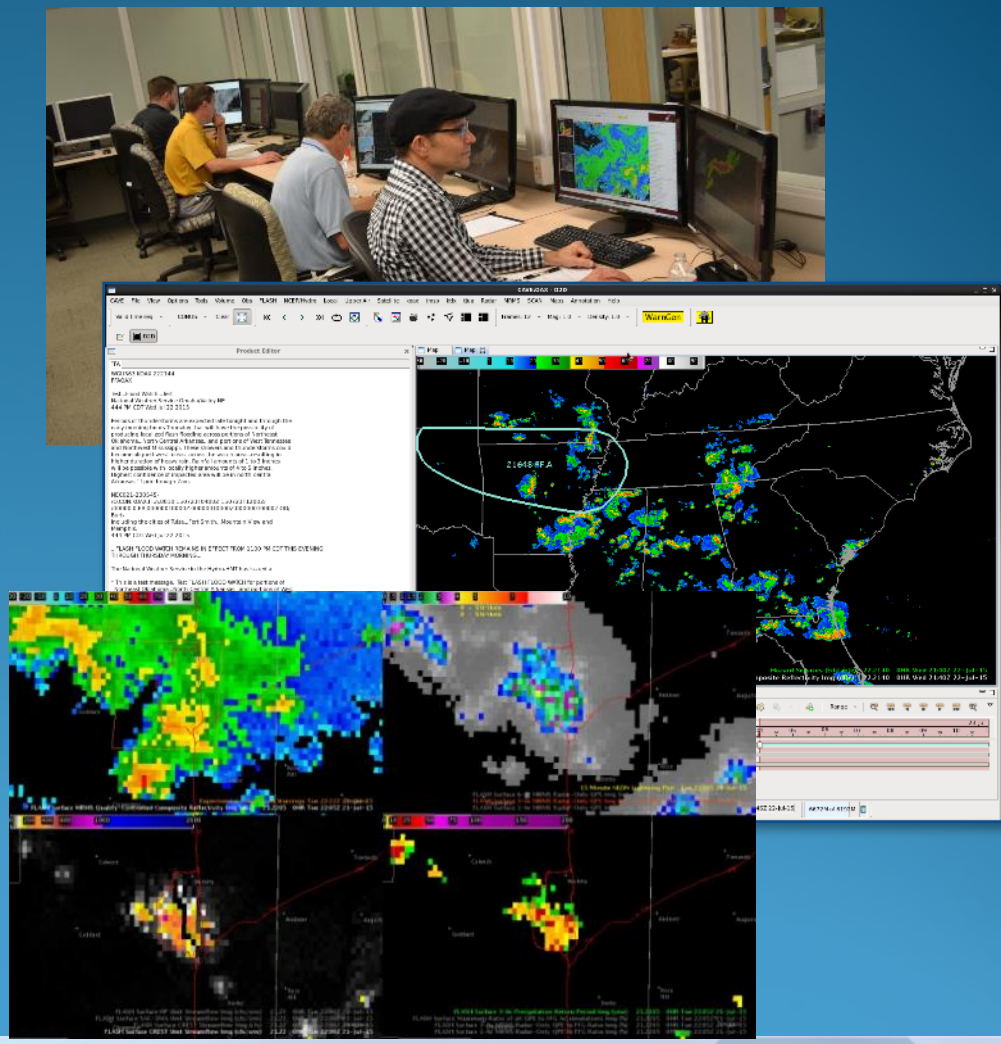






Project #3 (HMT/OWAQ): Hydrometeorological Testbed Multi-Radar Multi-Sensor Hydro ~~Experiment~~ (HMT-Hydro)

- 18 NWS forecaster participants over 3 weeks in Norman, OK
- Evaluated flash flood prediction using products from the **MRMS** and **FLASH** suites, as well as QPFs from ADSTAT and Experimental HRRR
- Assessed probabilistic forecasts in experimental flash flood watches and warnings
- Assessed usability of **Hazard Services** software and utility of flash flood recommenders
- Collaborated with **FFaIR** Experiment to simulate workflow of flash flood forecasting



Project #4 (USWRP): Assessment of Gridded Hydrological Modeling for NWS Flash Flood Operations

Goal

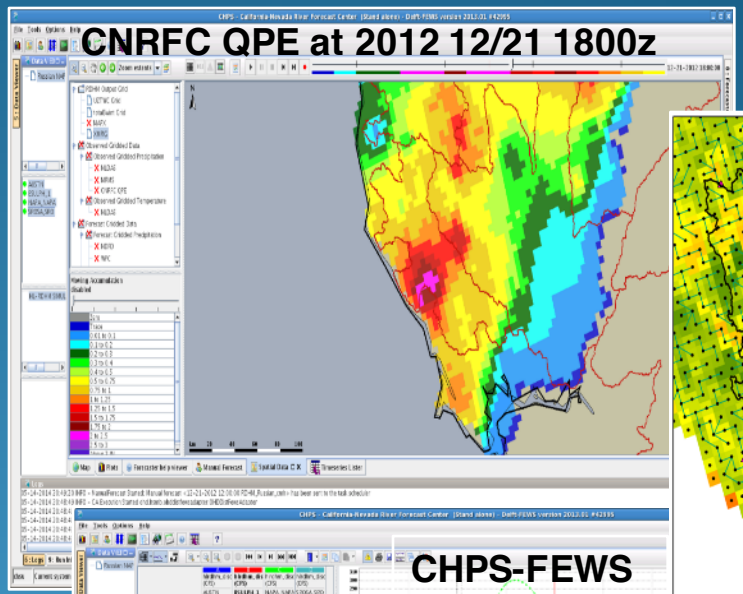
- Assess distributed hydrologic modeling approach for enhanced flash flood services.

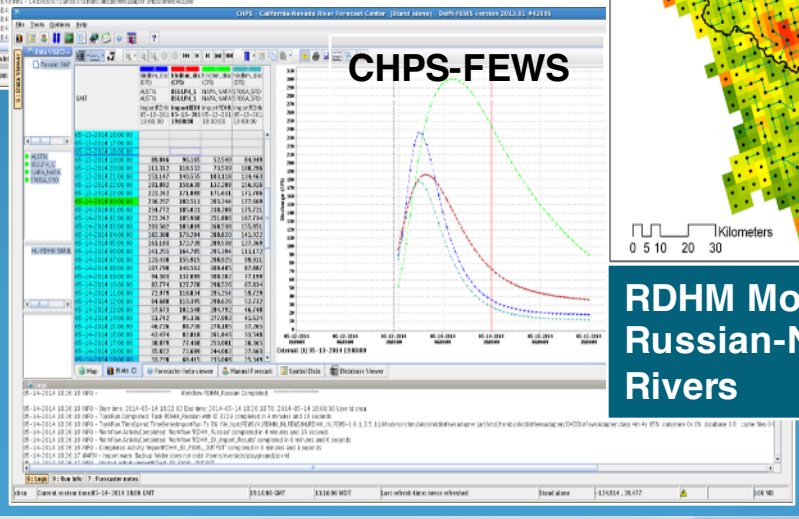
Participants

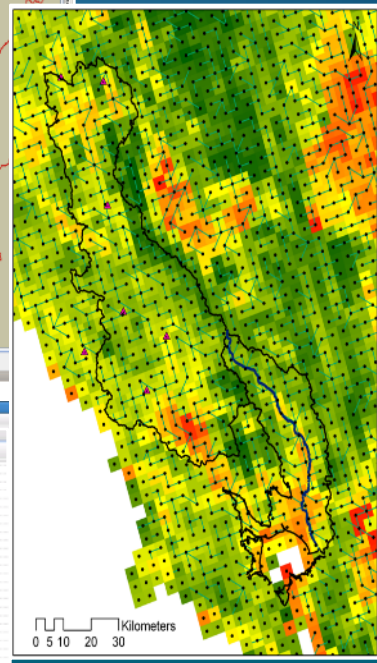
- CSU/CIRA & PSD (L. Johnson)
- Riverside Technology, Inc. (J. Halgren)
- HMT-West (NOAA ESRL PSD
- CNRFC and WFO-MTR

Tasks

- Implement the RDHM in CHPS-FEWS
- Build on existing RDHM model of the Russian-Napa Rivers
- Interface RDHM to real-time precipitation datasets
- Coordinate with NWS forecasters
- Examine concept of operations





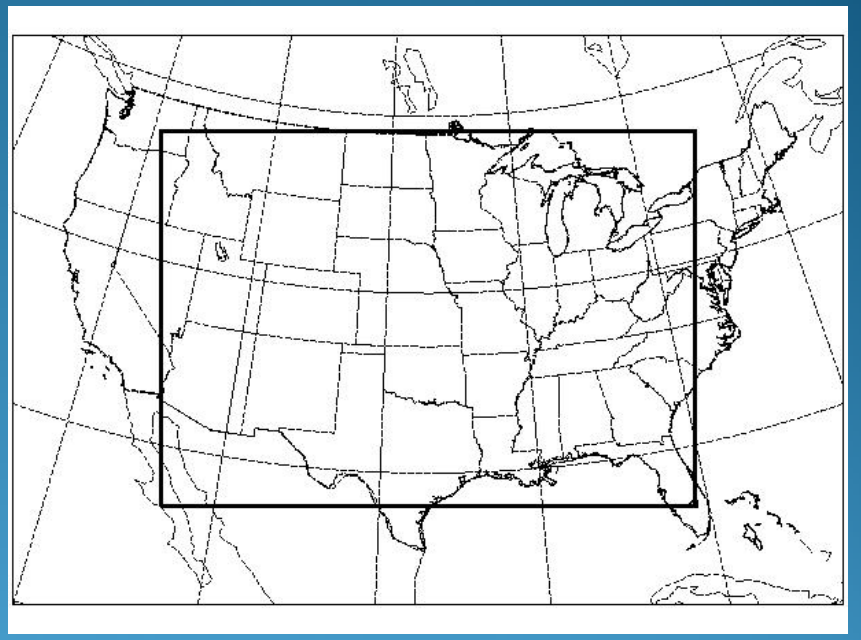


RDHM Model for Russian-Napa Rivers

Project #5 (USWRP): CAPS Storm Scale Ensemble Forecasts (SSEF) for HMT Flash Flood and Intense Rainfall (FFaIR)

- **3-km Horizontal Grid Spacing (1680×1152) Forecast Ensembles**
  - 1) 3DVAR SSEF: 20 ARW members, initiated with 3DVAR analysis & Cloud/Hydrometeor Analysis at 0000 UTC, with 60-h forecast
  - 2) EnKF SSEF: 40-member storm-scale ensemble background, a one hour EnKF cycling at 15 min interval, and a 11-member ensemble forecast starting at 0000 UTC.
- **Customized Forecast Output Products for FFAIR**
  - Precipitable Water
  - Integrated Water Vapor Transport
- **Customized Ensemble Probability Products**
  - Exceeding Flash Flood Guidance
  - Exceeding Climatological Extremes (Precipitation Recurrence Intervals)
  - Exceeding various fixed QPF limits at 3-h, 6-h,12-h, 24-h
- **Scientist Participation in FFaIR Forecasting at WPC**
  - 1 CAPS visiting scientist per week for 3 weeks

2016 SSEF 3-km DOMAIN



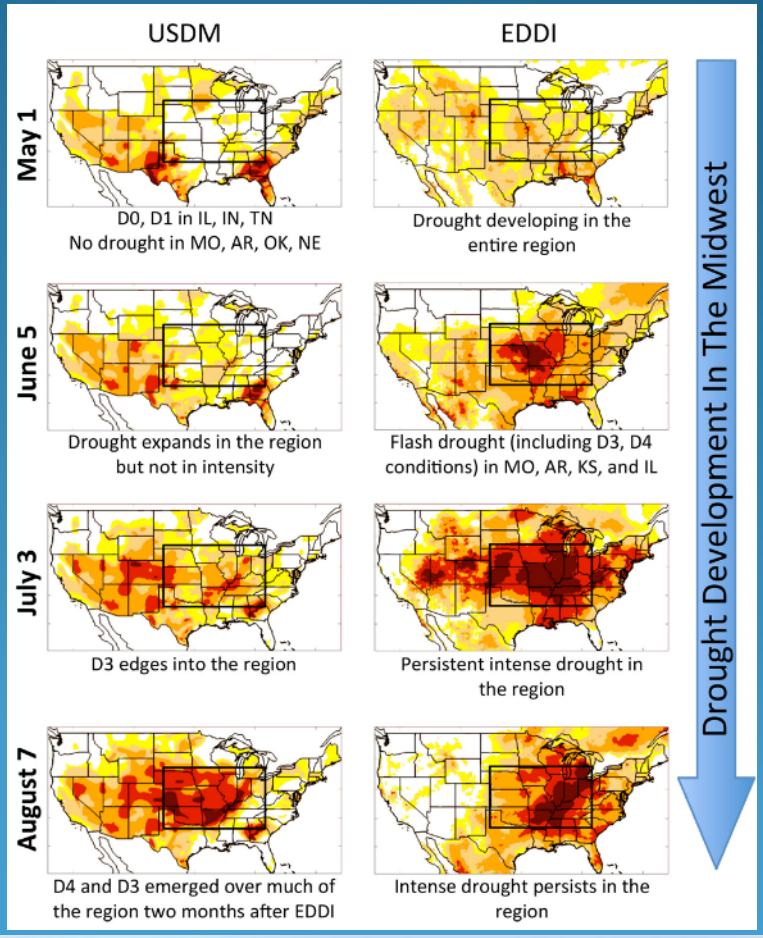
CONUS:1680x1152

NIDIS Supported Project: The Evaporative Demand Drought Index (EDDI)

- EDDI is solely a function of evaporative demand (PET)
  - PET estimated by ASCE Standardized Reference ET.
  - PET increases in both flash and sustained drought.
- EDDI provides early warning and ongoing monitoring of **flash** and **sustained** droughts in **agricultural** and **hydrologic** sectors and **of fire-weather** risk.
- Low latency (~5 days).
- Multi-scalar in time and space.
- Proposal to operationalize EDDI at National Water Center

- For more info: mike.hobbins@noaa.gov

Early warning of drought in Midwest, 2012



2-week EDDI (right column) compared at 5-week intervals to US Drought Monitor (left column).

EDDI captures severe drought conditions two months ahead of USDM.

WPC Key FY17 R2O Thrust

RESEARCH TO OPERATIONS

Establishing and Improving Probabilistic Services

-Particular focus on the forecaster and tools

Flash Flood and Intense Rainfall Experiment

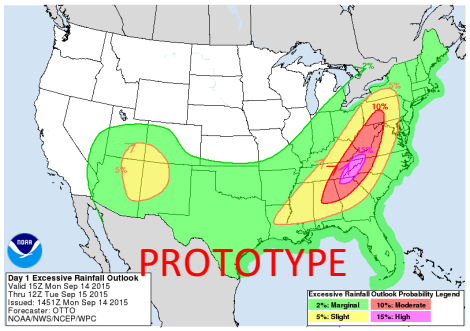
Winter Weather Experiment

Medium Range Experiments

NWS Hydrology Program

NWS Winter Wx Program

NWS Public Program



Day 8, 9, & 10 forecasts?

Plan: Twice monthly in experimental setting. Team of WPC, CPC, EMC, etc.…

Flash Flood and Intense Rainfall (FFaIR)

IN BOX
INSIGHTS and INNOVATIONS

Improving Flash Flood Forecasts

The HMT-WPC Flash Flood and Intense Rainfall Experiment

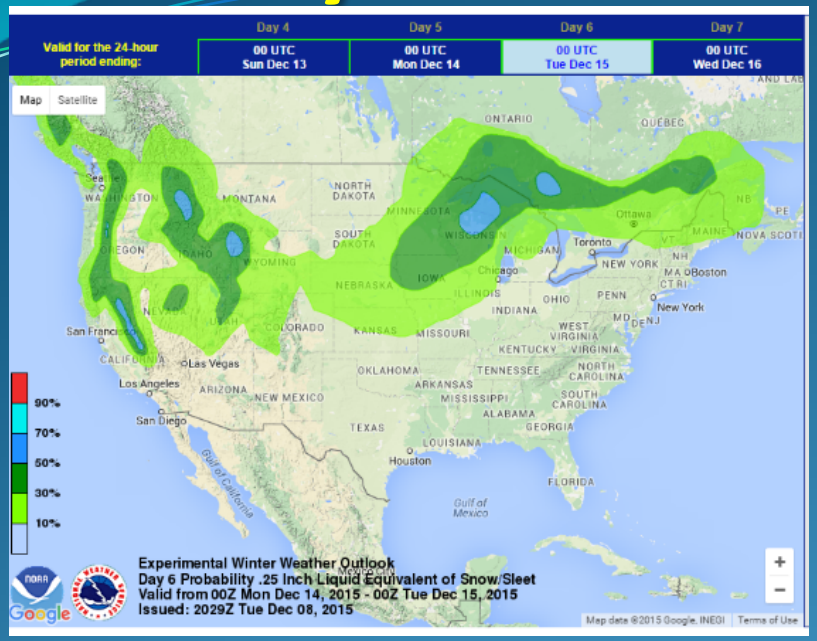
BY FAYE E. BARTHOLD, THOMAS E. WORKOFF, BRIAN A. COSGROVE, JONATHAN J. GOURLEY, DAVID R. NOVAK, AND KELLY M. MAHONEY

KEY NEEDS IDENTIFIED

- **Improved hydrologic guidance**—Hydrologic datasets targeted toward flash flood applications are necessary.
- **Improved warm-season model QPF guidance**—Convection-allowing models, including the establishment of an operational storm scale ensemble, is vital
- **Improved flash flood forecast tools**—Combining meteorological and hydrologic data needs to be explored.

- Near-real time experiment focusing community on flash flood forecast improvements
- 4 pm Talk "The Experimental Neighborhood Probabilistic Excessive Rainfall Outlook as Gleaned from the 2014 and 2015 Flash Flood and Excessive Rainfall Experiments, **Sarah Perfater**

Day 4-7 Winter Weather Outlook



- After 3 years of increasingly sophisticated testing and development, the Day 4-7 Winter Weather Outlook went publically experimental
- Popular among media
- Used for real-time DSS in Eastern U.S. Blizzard

3:20 pm: Transfer of Probabilistic Winter Weather Products from WPC Test Bed to Operations, **Michael Bodner**

Upcoming Activities

2016 FFaIR: June 20-July 19 at WPC

Focus: 1) Improving probabilistic flash flood forecasts
2) Testing convection allowing ensembles
2) Use of National Water Model output

NGGPS Funded Partner Projects

- Bosart and Keyser, SUNY Albany, "An Investigation of the Skill of Week Two Extreme Temperature and Precipitation Forecasts at the NCEP-WPC“
- Colle and Chang, Stony Brook University, "Validation of Significant Weather Features and Processes in Operational Models Using a Cyclone Relative Approach."

HMT Competition

- New announcement soon.

Summary

- **New Charter Development fostering clarity in roles and responsibilities in new funding paradigm**
- **Five OWAQ Supported Projects and one NIDIS Supported Project ongoing**
  - **Range from microphysics to ensembles to hydrology in scope**
- **WPC-led Winter Weather and Flash Flood Experiments advancing new products**
  - **Day 4-7 Winter Weather Outlook**
  - **Excessive Rainfall Outlook changes**

Backup Slides